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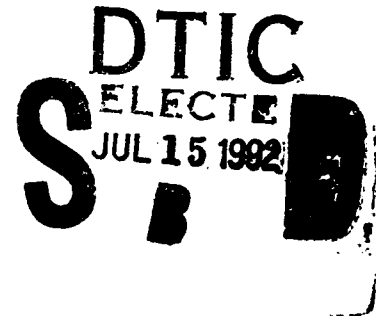


## CD-ROM LABELING TECHNIQUES

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CD-ROM LABELS

Ron Kushnier  
NAWC Code 5053  
06 JAN 92

**INTRODUCTION**

The Naval Air Warfare Center is currently involved in CD-ROM development for the United States military. Labeling techniques for Government CD-ROM discs require careful selection and design for the reasons outlined in this report.

**BACKGROUND**

A CD-ROM disc is manufactured by injecting or pressing a polycarbonate material with microscopic pits in one continuous spiral pattern. A reflective layer of aluminum or gold is then deposited over the polycarbonate. Then a protective layer of material such as DIC-17 is spun across the surface of the metal. And, finally, for product-type CD's, a label is "Print Screened" onto the finished product.

It was found that the quality of CD-ROM discs vary greatly as to the producer's manufacturing process, top-coating protective material, and labeling techniques. Ineffective seal coat material and it's application has been shown to be the "weak link" in CD-ROM longevity. Disc failure has resulted from penetration of contaminants into the metalized reflective layer. Some manufacturers metalize their discs to the edges thereby not providing a hermetic seal to the environment. Improper silkscreen and labeling inks can produce a migration effect into the metalized layer, thereby destroying the disk.

In addition, paper labels for CD-ROM have been shown to peel in high heat and humidity environments, taking the seal coat and reflective layer with them.

**CD-WRITE ONCE**

There is a requirement to create customized CD-ROM discs to be used by several Navy programs and Government agencies. A WRITABLE CD-ROM prototype generation station is currently available which will allow production of small quantities of discs customized for in-house distribution of specific database applications. These discs are delivered blank and contain no label markings. The manufacturer suggests that the disks can be pre-stamped with print-screen labels, in much the same manner as they do their standard CD-ROMs. However, since the WRITE-ONCE product is made as a very limited production item, the purchase of a large quantity of discs with generic labels might prove to be wasteful. Specific title, classification, and other pertinent information must be added to the label in the field. Sony suggests that a "Sharpie" marker pen, which incorporates a

permanent, alcohol-based ink, be used for this purpose. Other methods which would give more professional looking results, as well as provide additional security and label reliability are required.

#### **LABELING METHODS**

The first consideration is to create labels which are concentric. There have been reports that placing a floppy disk, or address label onto a CD causes an unbalancing of the disc while in the drive, thus inducing errors as a result.

Due to an urgent requirement, a number of different methods involving sticky, paper labels and plastic transparencies have been produced in-house for quick turn-around. The design and fabrication of these labels should not be construed as a permanent or final solution for the WRITE-ONCE label problem. Plain paper labels have been tested in harsh environments with poor results. In high heat and humidity, the paper label peeled, taking the disc's protective coating and metalized layer with it. These procedures are incorporated in this report only to demonstrate the experiments tried.

The label designs were produced on a Macintosh computer using various graphic programs including MacPaint, MacDraw, and Cricket Paint (See Figure 1.0). It is interesting to point out that CD manufacturers are accepting MacDraw files on floppy disk for production of their disc label artwork.

Output was to a LASER printer. Several print media were tried. The first, of course, was standard 8 1/2 X 11 inch copier paper. This was latter supplemented by Nashua XL-700 adhesive-backed, 8 1/2 X 11 paper labels. Another approach was to use 3M, 8 1/2 X 11 inch, 665 PPC Transparency Film for Overhead Projection. Additionally, 10 X 12 inch plastic transparency sheets with adhesive on the back were tried. These have a Federal Stock No. 9330-00-618-7215. It should be pointed out that when working with the transparency films, the "back door" of the LASER printer should be opened so that the sheets do not have to come through the full roller mechanism. The paper labels, and the 3M transparency films were bonded to the disc with a thin coating of spray adhesive such as CROWN #8091 applied only to the label. The label was allowed to dry thoroughly before application to the disc, so that the solvent used would have dispersed. Use of this, or any adhesive is risky if the chemical composition and solvents used are not known. Some acid based adhesives have been reported to have eaten through the disc's protective layer and destroyed the metalized coating underneath.

The adhesive-backed plastic transparency sheets came through the LASER printer looking fine. However, it was found that the ink would not firmly adhere to the plastic. Therefore a photographic lacquer such as "Blair Spray Fix" No. 105FL was applied over the label. This

fixed the printing. However, it should be noted that the label could be scratched easily and the printing damaged. As a result, and to protect the actual labels from environmental damage, a second layer of adhesive-backed plastic was applied over the labels. Dimensions of the label and overcoat were adjusted so that the overcoat sealed the paper label beneath on both the inner and outer rims of the disc.

The round labels were cut from the rectangular sheets using an OLFA compass cutter model CMP-1. This device will cut precision circles from 1 to 15 cm in diameter. It has been found to be an extremely useful device.

### COMMERCIAL HELP

During the investigation, several commercially available labeling items were evaluated. DEMCO Inc. of Madison Wisconsin offers a number of interesting products. Among these is an "Identadisc" system for embossing information around the disc's center ring. Up to thirty characters can be imprinted. Subsequent conversations with the manufacturer, HI-PRO-TECH INC. of Lansdale, Pa., provided valuable information about the concerns of disc embrittlement and chemical effects on CD-ROM media. These effects will be considered in upcoming environmental tests to be conducted at the Naval Air Warfare Center.

Another product originally located through DEMCO was the CD Foil Shield. This plastic film claimed to protect the label and music side of an audio disc and even to enhance CD sound quality. A request to the manufacturer, CYX International of Leiden Holland, to substantiate this claim led to a response by them and Gressco, Ltd., Madison Wisconsin, their American representative. They presented a number of test reports, technical specifications and European magazine articles describing the CYX Foil Shields. These articles gave a positive review of the device for CD-Audio discs. One paper mentions a vibration-dampening effect of the foil for improved performance, but this has yet to be proven.

Plastic foil shields for CD-ROM are also sold by Disc Hotel Inc. Boise, Idaho. Their vinyl, 2-3 mil shield has been specially manufactured with suitable adhesive (beeswax) for use with CD-ROM. Both foils can be printed with customer-labeled, generic information.

Two experimental labeling techniques were tried with the help of commercial vendors. The first technique consisted of producing a large rubber stamp with the required CD-ROM generic information. Again, the artwork was produced on a Macintosh and delivered to A. A. Russell Inc., Philadelphia, PA. for manufacture (Figure 2.0). Special "CRYOVAC" ink was recommended by the company to insure non-reaction with the CD-ROM top-coat material.

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Because of the large size of the stamp, it was difficult to register properly with the disc. It was thought that a fixture would need to be fabricated which would align the two components. However, several other negative factors led to temporarily abandon this approach. The stamp, again because of its size, would not uniformly deliver ink to the disc. Some of the lettering was missing, while some was over-printed and smudged. The CRYOVAC ink dried too quickly. The stamp stuck to the surface of the disc. It was found to damage the protective coating. A polyethylene ink was substituted, but results were similar. Sources for a UV-cured ink, similar to that used for CD-ROM screen-print labels, were sought. Discussion with Norcote, Crawfordsville, IN, indicated that they produced UV-cured inks for screen printing, but not pad printing. They also outlined the complex curing process and the special equipment needed.

A second approach was to produce static-sensitive, removable CD labels. These were manufactured by Decal Craft, Hatfield, PA. The transparent plastic foil adheres to the disc through a surface tension effect without the use of adhesive. The labels "stuck" remarkably well to the WRITE-ONCE media. One modification to the original design (Figure 3.0, 4.0) was to increase the size of the center hole from 15mm to 33.5 mm. This was necessary to prevent the sprockets in the jewel case from pushing up the label when the disc was inserted.

It was found that additional printing could be added to the label with the use of a Macintosh computer, and further processing through a LASER printer. Basically, a sample of the required disc label was printed on 8 1/2 X 11 inch paper (Figure 5.0). Then the static label, with backing attached, was glued onto the paper over the printed sample. The guide lines and circles were removed from the MacDraw file and the label was sent through the printer. The "back door" of the printer was left open so that the label was not required to go through the complete roller process. The label was then peeled off the backing and applied to the disc.

Certainly better, more efficient ways can be found to facilitate this process. The use of blank 8 1/2 X 11 inch static sensitive sheets may be a solution.

Environmental testing of these labels in harsh environments is planned during the upcoming tests at NAWC.

## SECURITY CLASSIFICATION LABELS

As part of a program for the establishment of an in-house CLASSIFIED CD-ROM facility at NAWC, it was necessary to demonstrate a means to provide for physical labeling of the CD-ROM discs which would provide proper classification level. A label was needed which would incorporate Tri-service and other U.S. Government coordination, standardized text, standardized colors, and standardized format. Approved rectangular labels were found as part of the Intelligence Community Standards for Security labeling of Removable ADP Storage Media, Director of Central Intelligence Directive 3/14, Appendix B, effective 17 November 1986 ( See Figure 6.0). These consisted of:

NSN 7540-01-207-5536	SF 706 (1-87)	"TOP SECRET"
NSN 7540-01-207-5537	SF 707 (1-87)	"SECRET"
NSN 7540-01-207-5538	SF 708 (1-87)	"CONFIDENTIAL"
NSN 7440-01-207-5539	SF 710 (1-87)	"UNCLASSIFIED"
NSN 7540-01-207-5540	SF 709 (1-87)	"CLASSIFIED"

Artwork was generated in-house for design of circular labels based on the approved standard. The series of labels, produced in the specified colors, can be mounted on the label side of the disc over the inner ring. This ring does not contain data, and since the label is circular, no disc unbalancing should be evident. The self adhesive label is mounted to the disc using a small thimble, as a guide to center the paper disc. It should be noted that the labels are slightly different sizes so that the highest security classification can always be seen even if a lower classification label is placed on top.

Although the paper labels are not placed over data areas, there was concern of what might happen to them if exposed to a harsh environment. This concern was based on previous NAWC testing of paper labeled CD-ROMs in high heat and humidity environments. As a result, plastic vinyl labels are being procured.



SOURCES OF MATERIALS

DECAL CRAFT  
Route 309  
Hatfield PA 19440  
(215) 822-0517

Koenig Artist Supplies  
25 S. 8th St.  
Phila. PA 19106  
(215) 627-6655

A.A. Russell  
728 Chestnut St.  
Phila. PA 19106  
(215) 922-5058

XEROX  
PO BOX 9670  
Arlington VA 22219  
(800) 822-2200

DEMCO INC.  
BOX 7488  
Madison Wisconsin 53707  
(800) 356-1200

Disc Hotel Inc.  
4595 Savanna Lane  
Boise, Idaho 83703  
(208) 853-4802

Gressco, Ltd.  
PO BOX 7444  
Madison Wisconsin 53707  
(800) 345-3480  
High PRO

NORCOTE  
506 Layfayette  
P.O. Box 668  
Crawfordsville, IN 47933  
317-362-9180

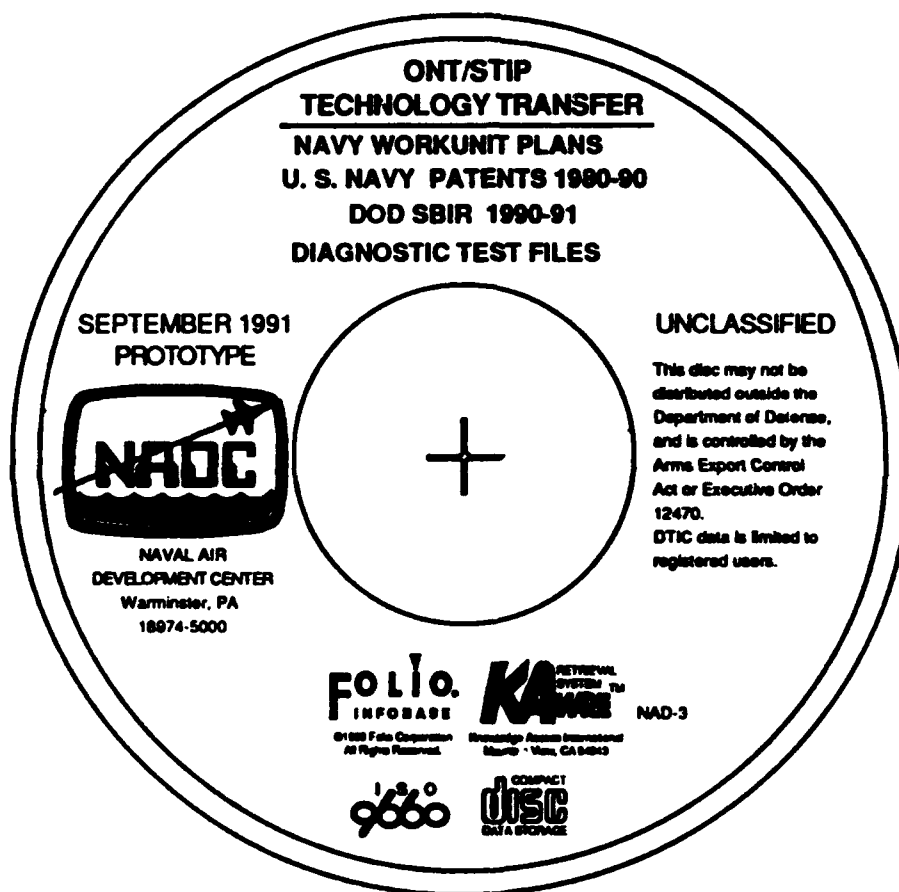


Figure 1.0

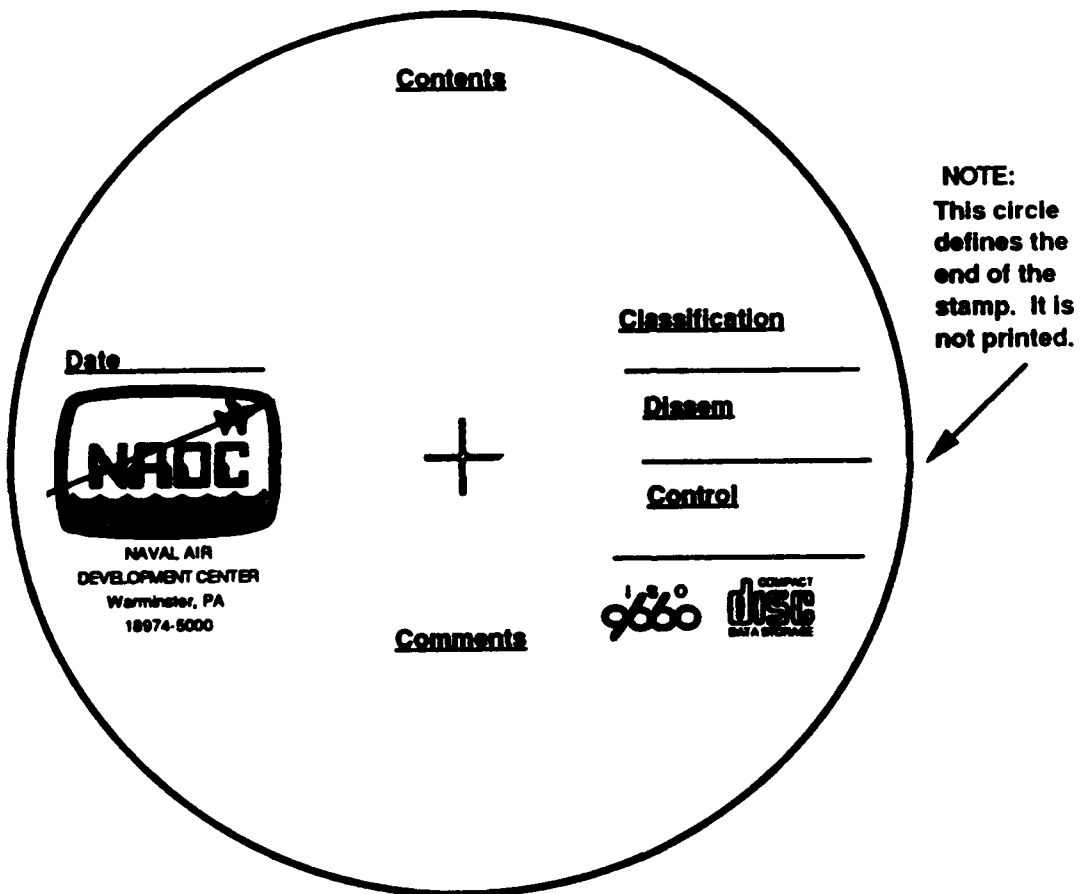


Figure 2.0

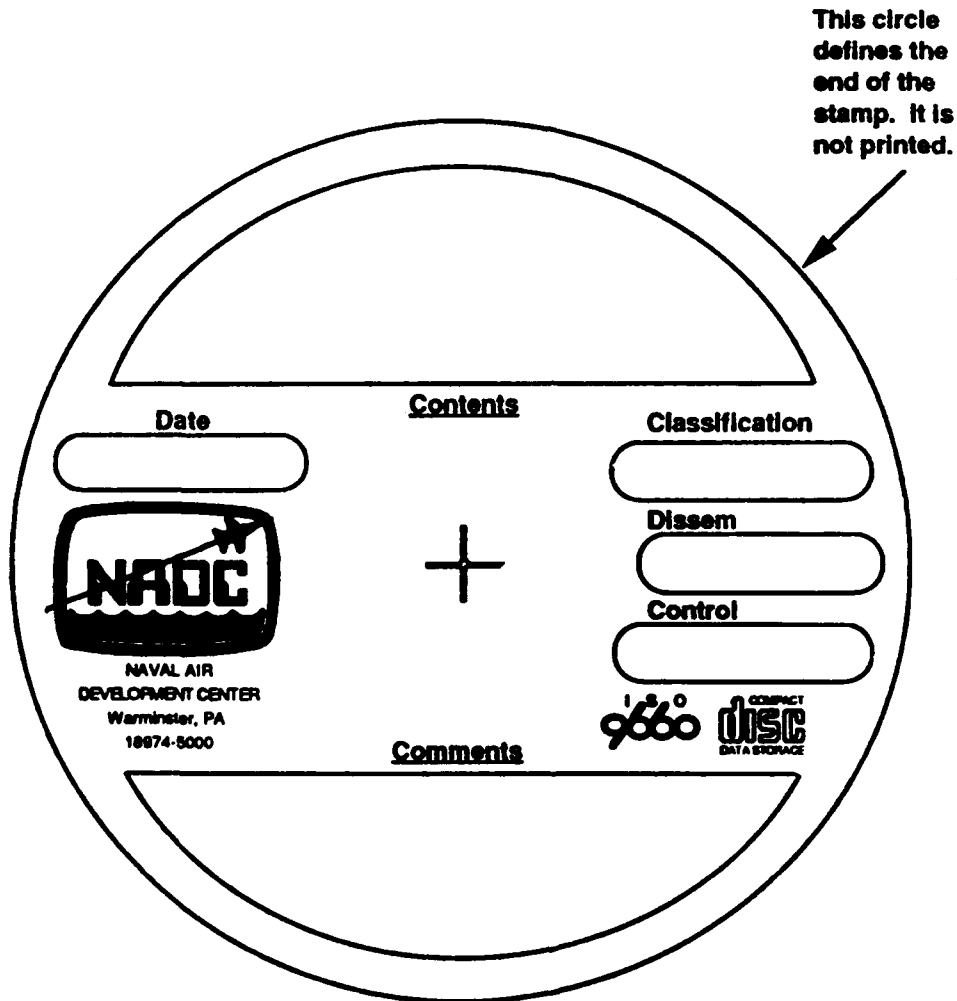


Figure 3.0

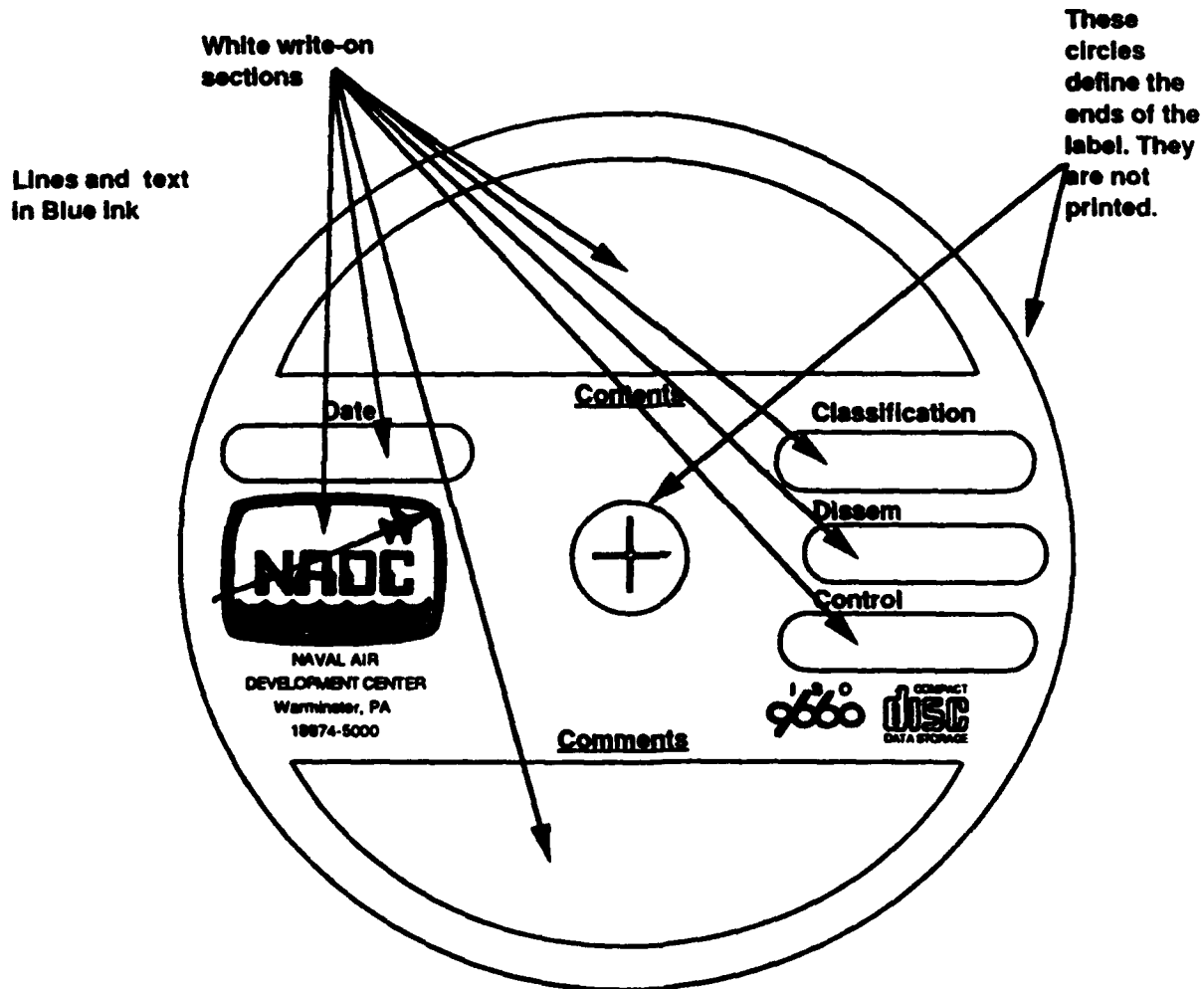


Figure 4.0

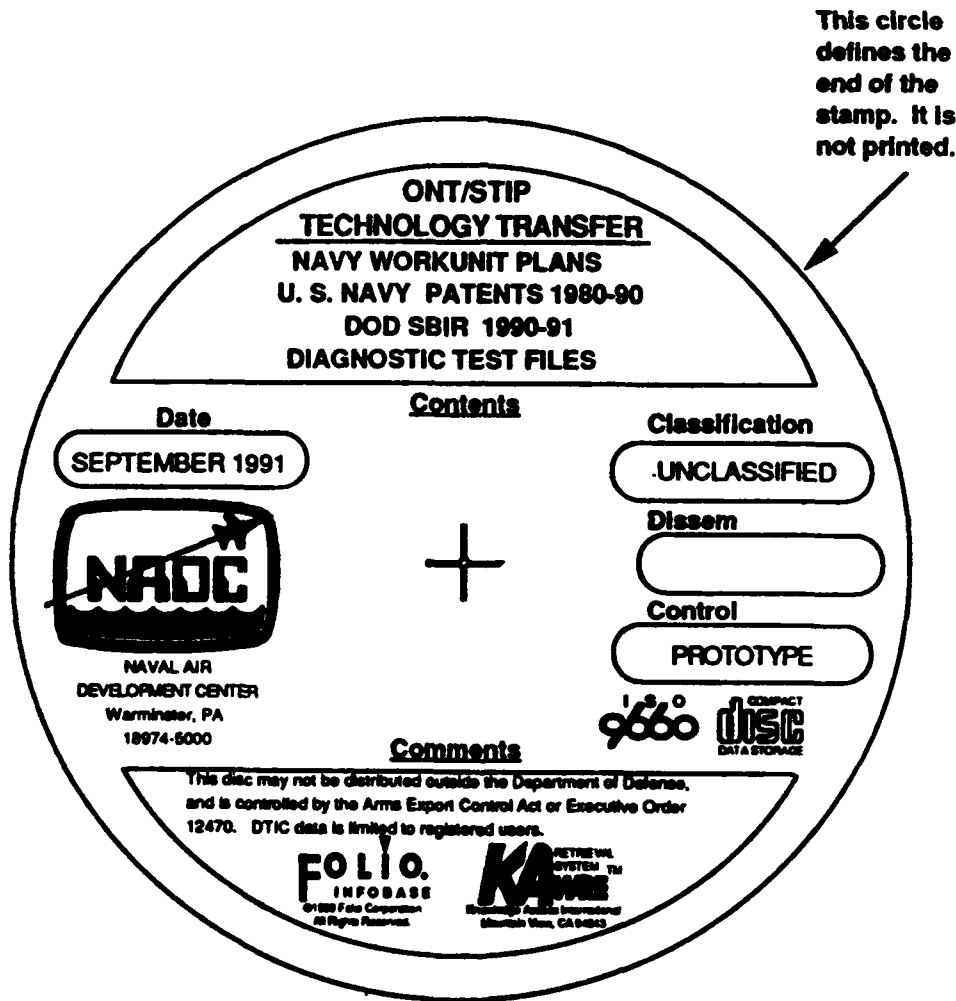
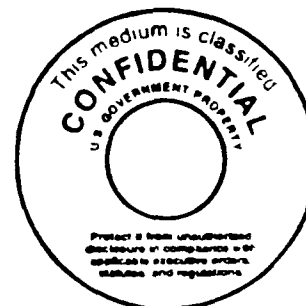
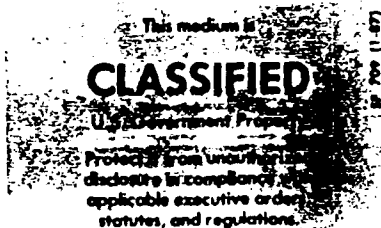
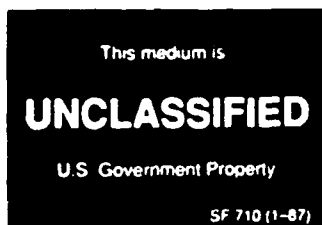
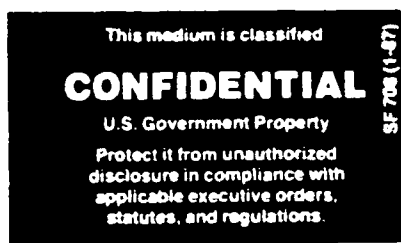


Figure 5.0



PMS COLORS

TOP SECRET- 165

SECRET- 186

CONFIDENTIAL- 286

UNCLASSIFIED- 356

CLASSIFIED- 264

Figure 6.0

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